PROGRESS UPDATE: INDIANA PURPLE LOOSESTRIFE BIOLOGICAL CONTROL

Indiana Department of Natural Resources
Division of Nature Preserves, and
Division of Entomology and Plant Pathology

John Ervin, Richard Dunbar, Joshua Grubaugh, Nathan Simons

Purple Loosestrife in Indiana

- Purple loosestrife was brought to the United States from Europe in the 1800's.
- It has become a serious pest to native wetland communities
  - Out-competes native plants.
  - Alters hydrology
  - Alters soil and nutrient processes

Purple Loosestrife in Indiana

- To control the spread of purple loosestrife, a state law was enacted on July 1, 1996, that prohibits the sale of ALL forms of purple loosestrife (any variety, species, horticultural variety, cultivar), or other members of the genus *Lythrum*, whether reportedly sterile or not.

Biological Control

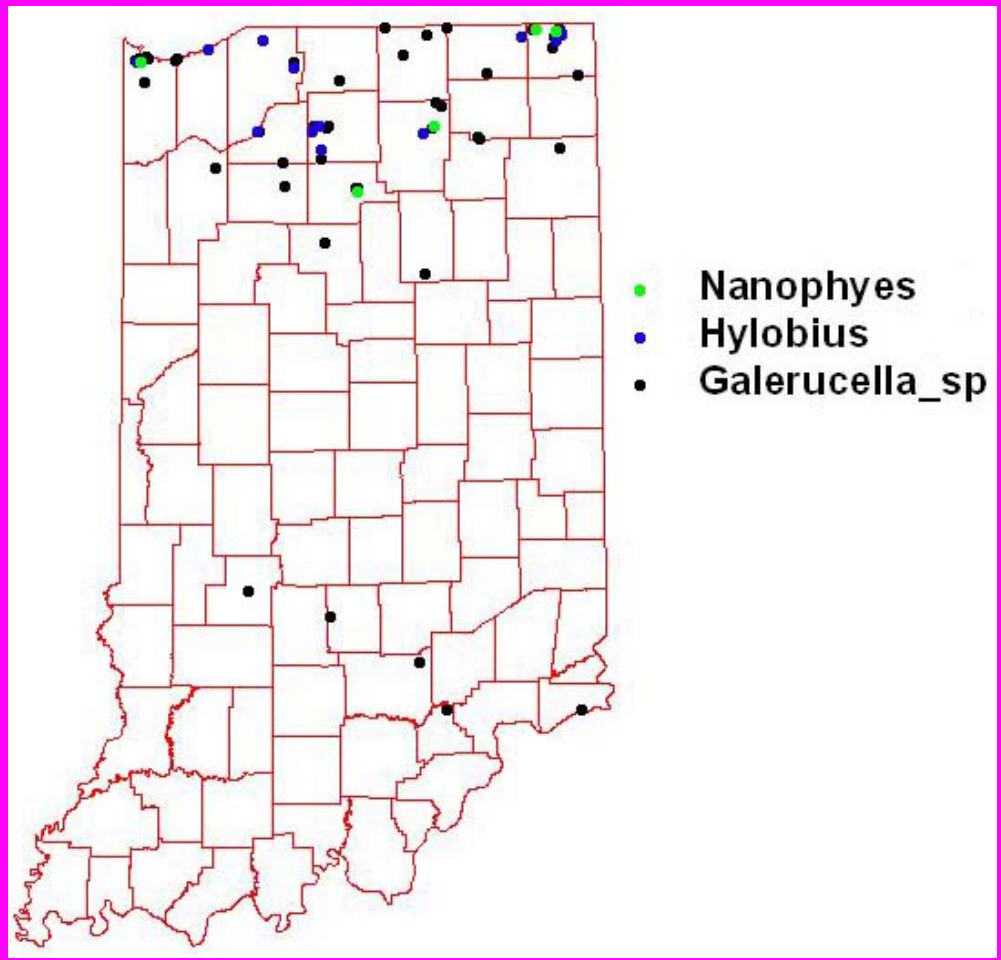
- In Indiana, releases of biological control insects against purple loosestrife began in 1994

Photo by Bernd Blossey

Biological Control

- As of 2004, all three available genera have been released by Indiana DNR, US Department of the Interior, APHIS, Indiana 4-H, and private landowners
- Released on 58 sites
- Released in 24 counties

Biocontrol Releases



Galerucella spp.

- Chysomelidae: Galerucellinae
- *Galerucella pusilla* and *Galerucella calmariensis*
- Introduced to North America in 1992
- Introduced to Indiana in 1994
- 1-year life-cycle; prolific reproduction
- Adults and larvae skeletonize leaves.



Don Hamilton, University of Guelph

Life Cycle

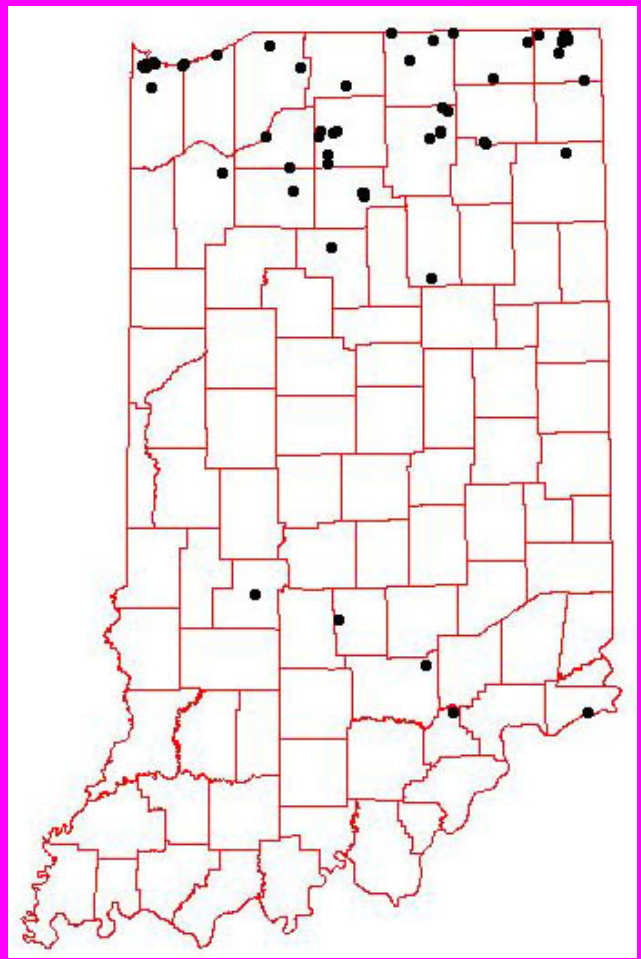
- Adults emerge from hibernation in mid-May
- Adults lightly feed, mate and oviposit through late June….dead by mid-July
- Larvae hatch, feed heavily, and pupate through late July
- Adults emerge from pupation from mid-July through mid-August (dispersal)

Galerucella History

- ***Releases***
  - ***1994: 6495 at 5 sites***
  - ***1996: 39600 at 18 sites (Reared by IDNR)***
  - ***1997: 49500 at 25 sites***
  - ***1998: 5000 at 2 sites***
  - ***1999: 18400 at 7 sites***
  - ***2000: 11500 at 11 sites***
  - ***2001: 2000 at 2 sites (Indiana capture and release)***
  - ***2002: 1000 at 1 site (Indiana capture and release)***
  - ***2003: 7700 at 5 sites (Indiana capture and release)***

- **76 releases have occurred at 48 sites of total release population 141195**
- **They have survived at least one year at 33 sites**
- **Perennially established at 20 sites**
- **11 sites have shown “moderate” to “severe” damage to purple loosestrife**
- **4 sites have been formally monitored**

Galerucella spp.



General Monitoring

- All release sites have been visited every year unless the population appears to have gone extinct
- Establishment has been monitored on a 7-point scale

  A=Beetles not found

  B=Beetles hard to find

  C=Beetles easy to find

  D=Moderate plant damage

  E=Patchy severe plant damage

  F=Widespread severe plant damage

  G=Control achieved

General Monitoring

- *2003 Galerucella spp.*
  - *3 sites showed widespread severe plant damage*
  - *7 sites showed patchy severe plant damage*
  - *1 site showed moderate plant damage*
  - *9 sites showed beetles “easy to find”*
  - *11 sites showed beetles “hard to find”*
  - *17 sites showed beetles “unable to find” or extinct*

Big Otter Lake 2001

Big Otter Lake 2003

Factors Negatively Affecting Establishment

- Predation
  - Ladybird Beetles
  - Birds
- Site shading
- Substrate flooding
- Competition
  - *Altica* spp. beetles
  - Four-lined Plant Bugs

Negative Effects

- Will sample non-target plants visibly when in population explosion
- Has damaged native Winged Loosestrife (*Lythrum alatum*)
  - Transect at Big Chapman Lake
  - Zero plants found in 2003 and 2004
- Has damaged Whorled Loosestrife (*Decodon verticillatus*)

Hylobius transversovittatus

- Curculionidae: Hylobiinae
- Introduction with eggs: 1995-1997
- Introduction with adults: 1998
- Up to 7 years life-cycle
- Slow reproduction
- Larvae feed in roots
- Adults are nocturnal

Bernd Blossey

Hylobis tranversovittatus History

- Releases
  - 1995: 800 at 4 sites (eggs)
  - 1996: 1104 at 3 sites (eggs)
  - 1997: 1987 at 5 sites (eggs)
  - 1998: 700 at 2 sites (adults)
  - 2001: 900 at 4sites (adults)
  - 2003: 1000 at 1 site (adults)

Bernd Blossey

- In total: 19 releases have occurred at 20 sites of total release population 6491
- One adult beetle has been found one year after release
- Sites of adult release have shown some reduction in plant vigor

Hylobius tranversovittatus

Bernd Blossey

Nanophyes marmoratus

Bernd Blossey

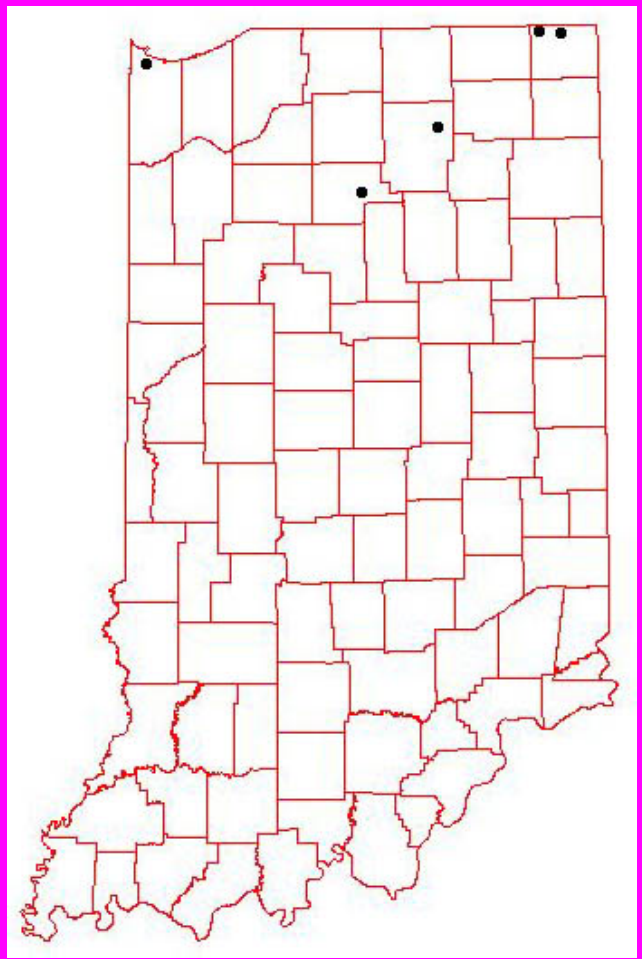
Nanophyes marmoratus History

- Curculionidae: Nanophyinae
- Flower feeder

- Releases
  - **2002: 1000 at 5 sites**
- Have become established at all sites

Eric Coombs, OR Dept. of Agric.

Nanopheyes marmoratus



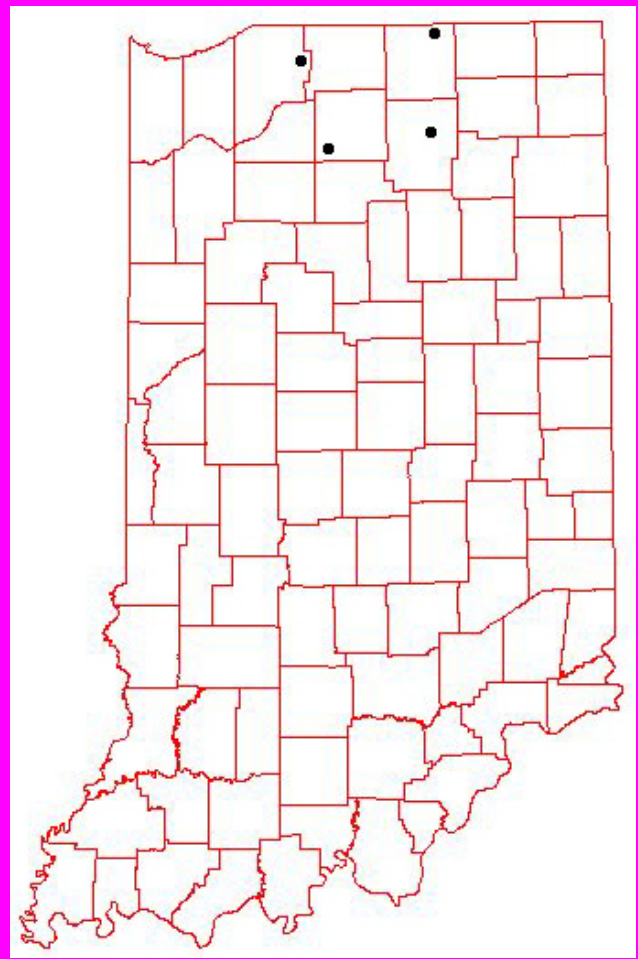
Eric Coombs, OR Dept. of Agric.

Formal Monitoring

- Four *Galerucella* spp. sites have been monitored using protocol designed at Cornell University
- Spring and Fall sampling

Formal Monitoring

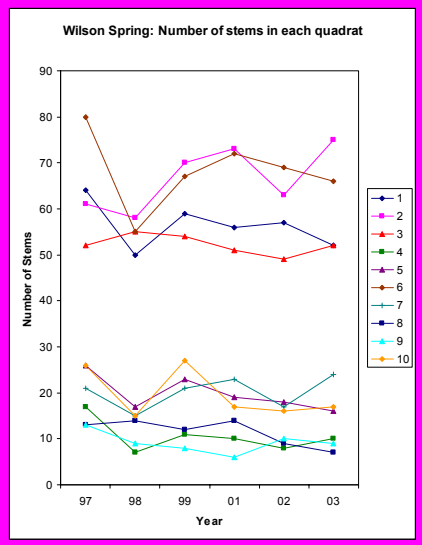
- Four sites
  - Wilson Wetland in Marshall County
  - Fish Creek Fen in Laporte County
  - Chapman Lake in Kosciusco County
  - Bonneyville Mills in Elkhart County

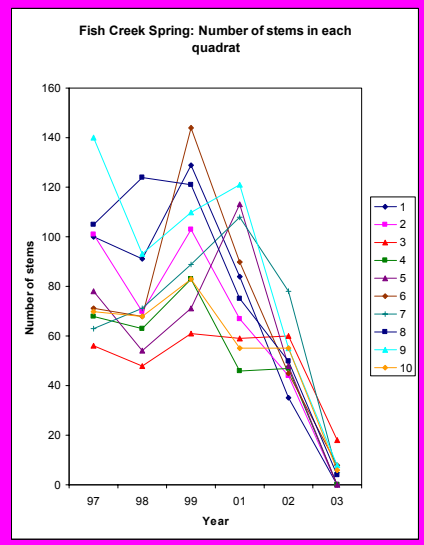


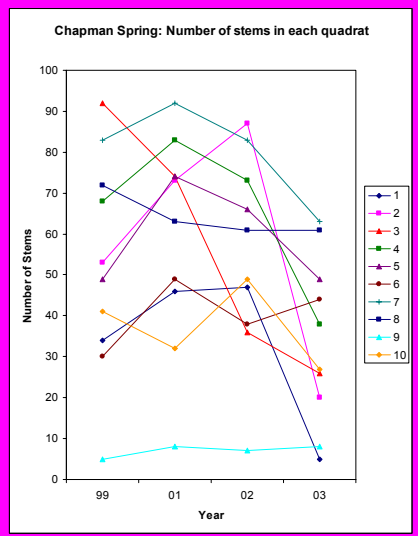
Measurements

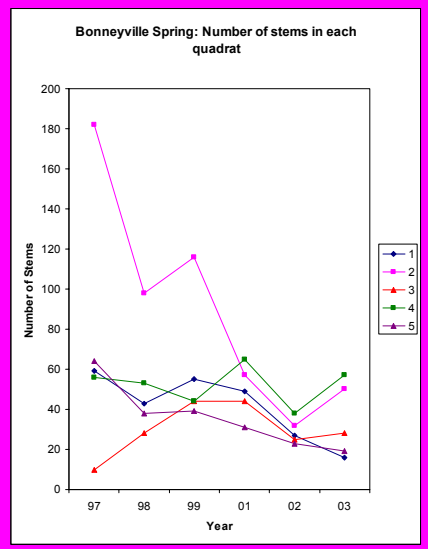
- Design
  - Ten permanent $1m^2$ quadrats per site
  - Spring [1 June (+/-)] and Fall samples [7 Sept (+/-)]
- Spring Data
  - Number of stems
  - Height of the 5 tallest stems
- Fall Data
  - Number of stems
  - Height of the 5 tallest stems
  - Number of inflorescences on each of the five tallest stems
  - Total number of inflorescences

Spring Number of Stems

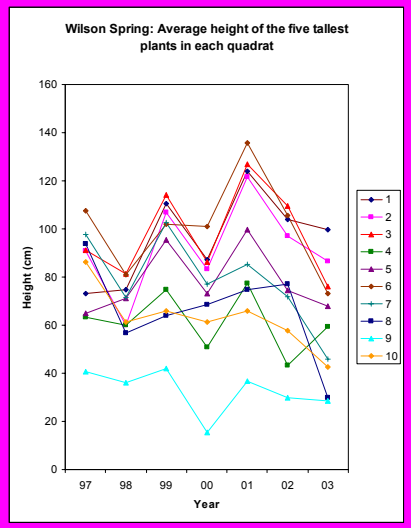


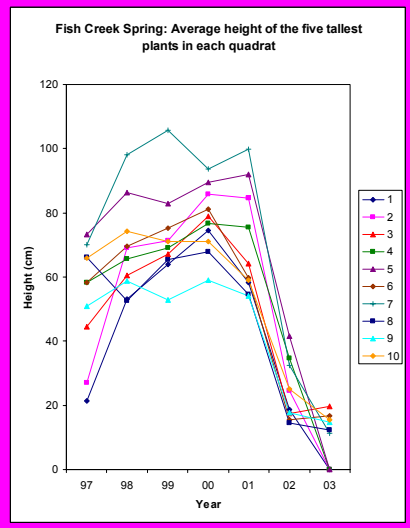


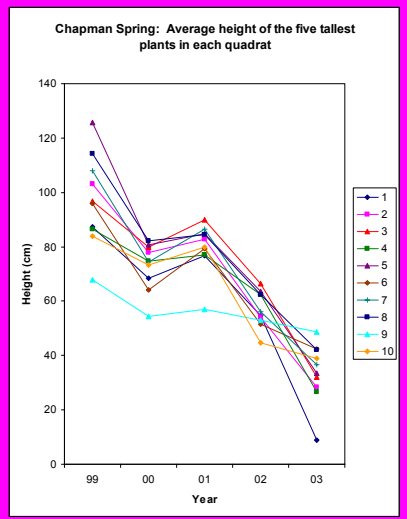


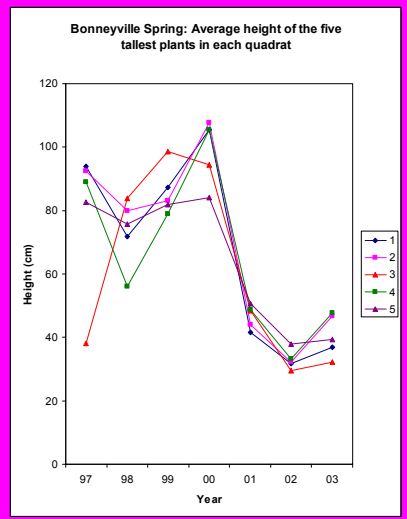


Spring Stem Height

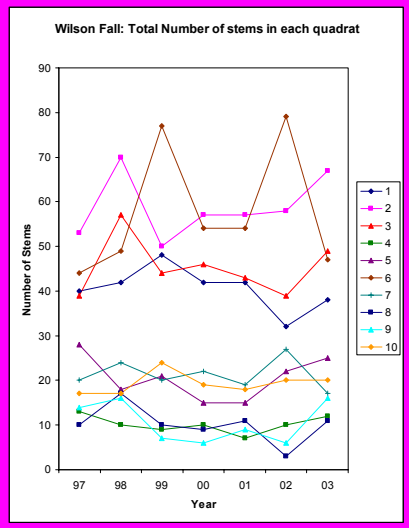


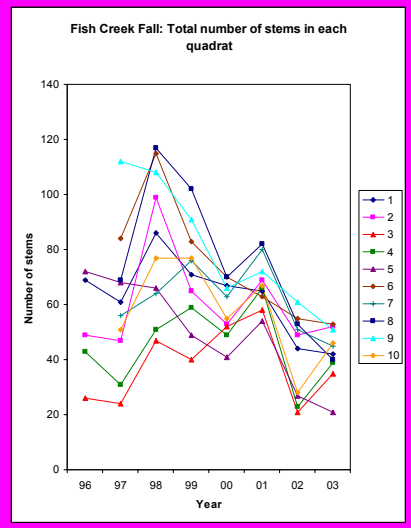


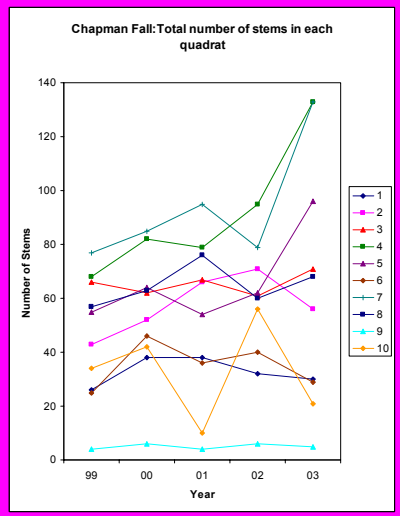


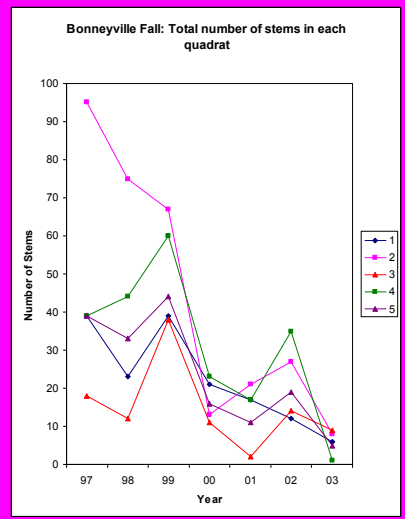


Fall Number of Stems

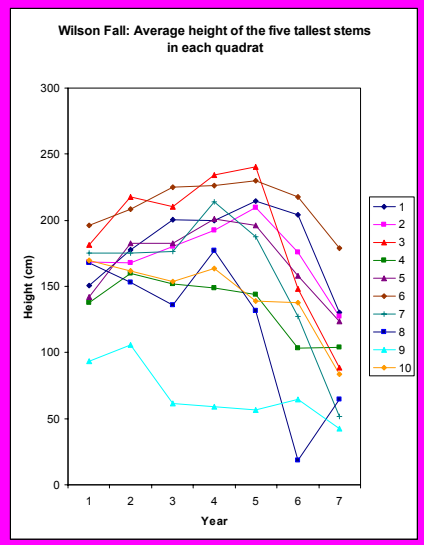


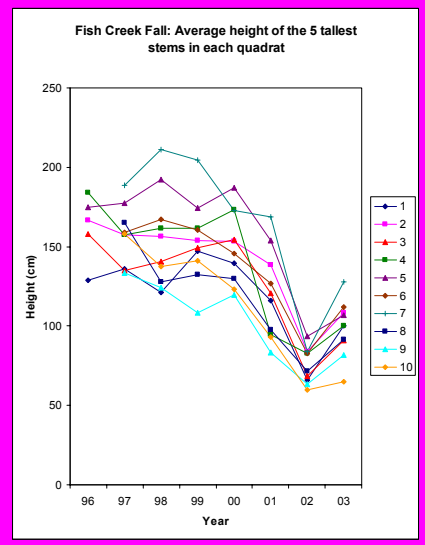


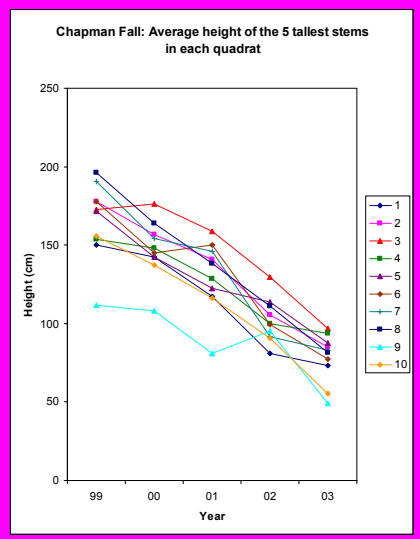


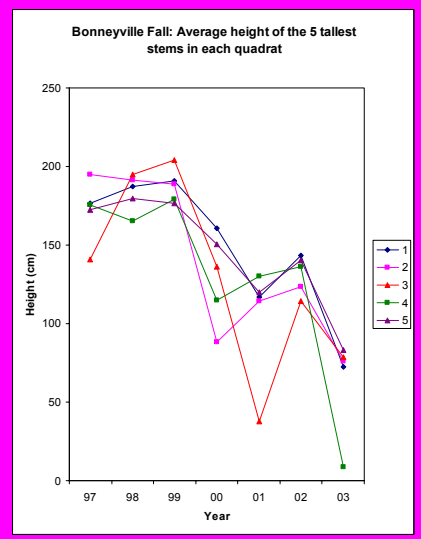


Fall Stem Height

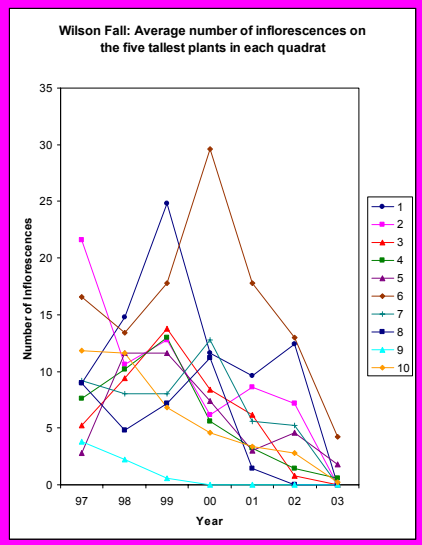


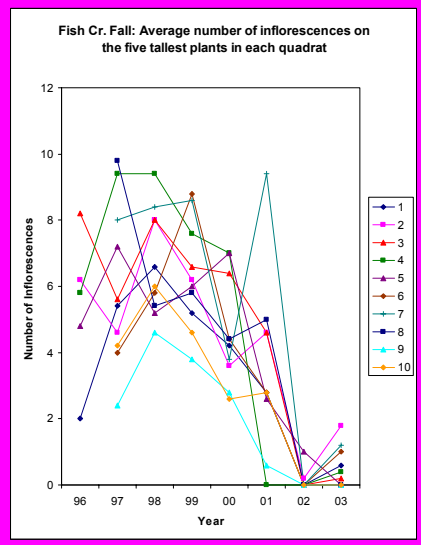


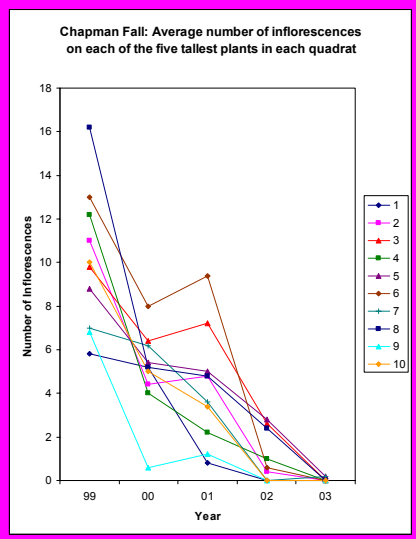


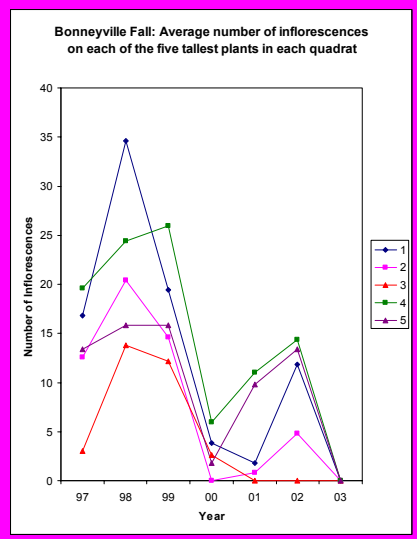


Average Number of Inflorescences

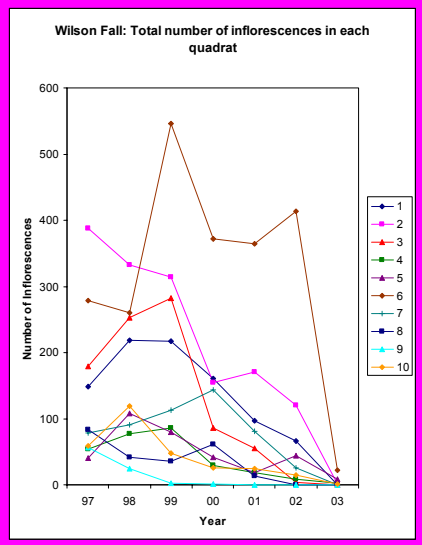


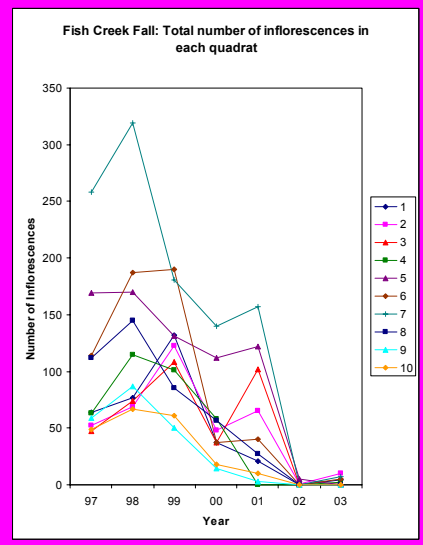


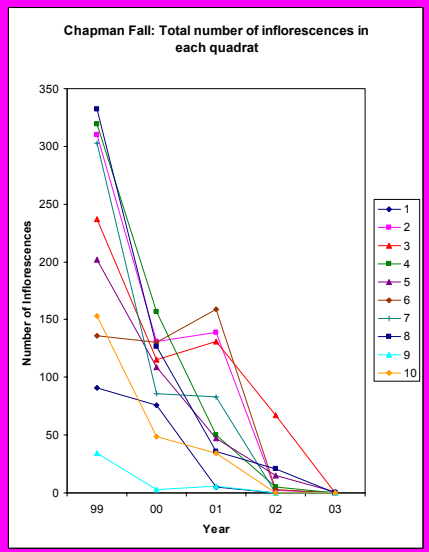


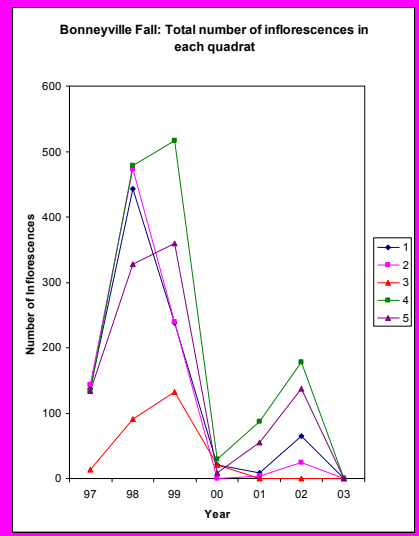


Total Number of Inflorescences

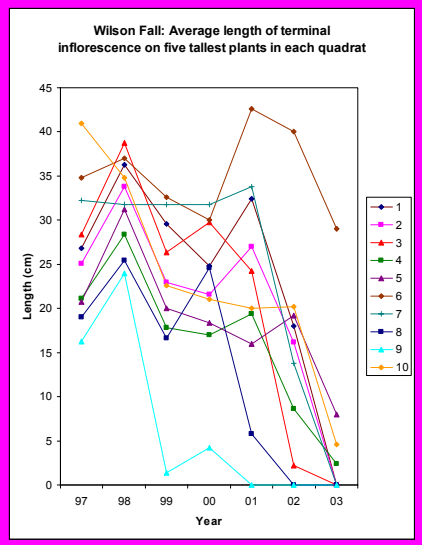


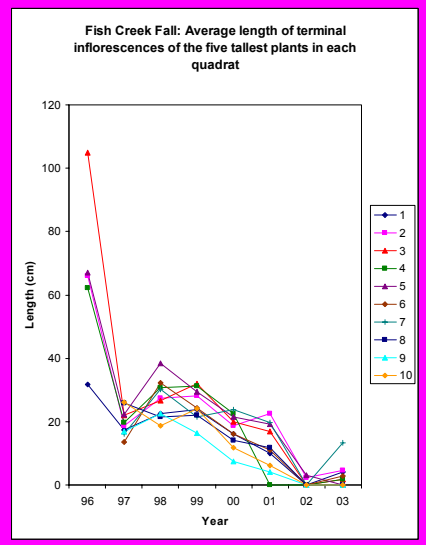


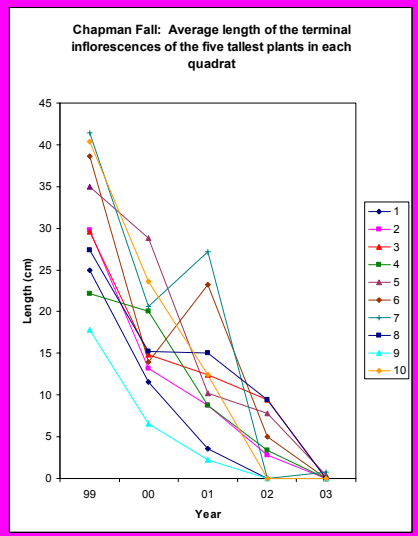


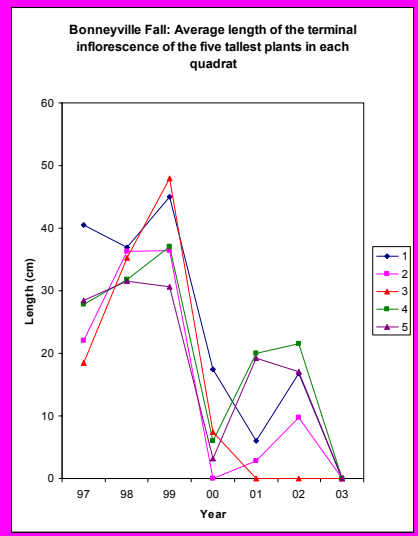


Length of Terminal Inflorescence

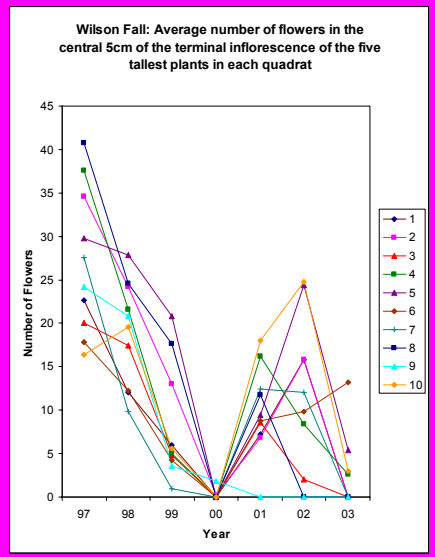


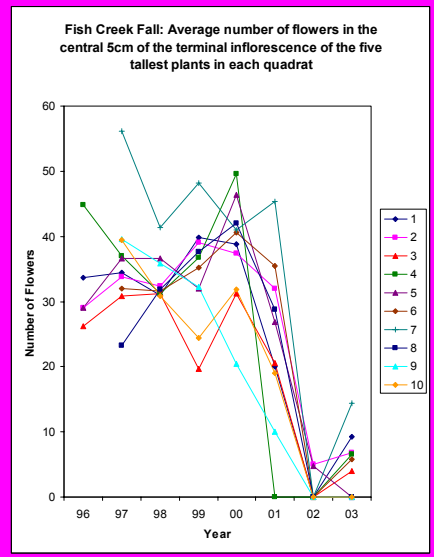


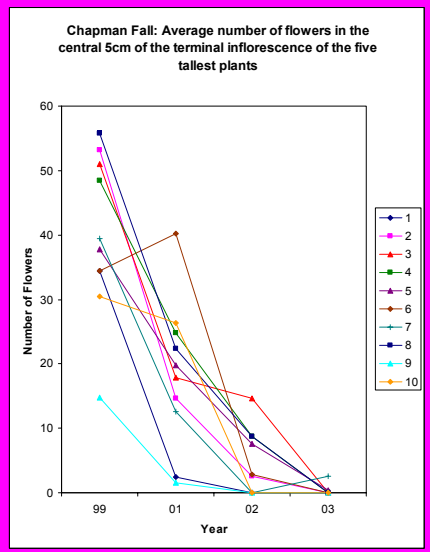


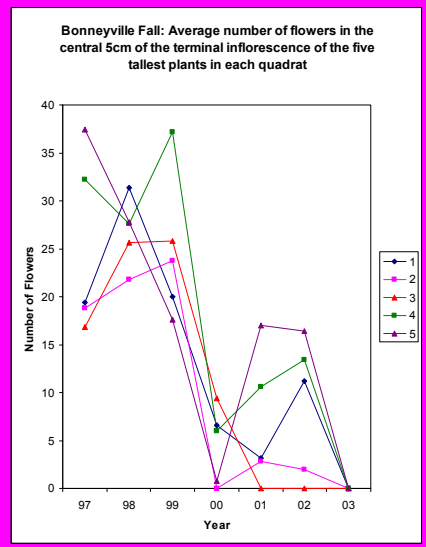


Number of Flowers









Conclusions

- Vegetative vigor has been moderately impacted
  - Number of stems reduced
  - Heights of stems reduce
- Reproductive vigor strongly impacted
  - Field observations at other generally-monitored sites are supported by these measurements